

recovered in step (c) at a temperature ranging between 80 to 110°C prior to the calcining.

10

15. (New)

3

A process as claimed in claim ~~8~~³, wherein the calcining in step (c) is carried out in three steps with the temperature in each of the three calcining steps being higher than the temperature in the preceding calcining step.

2

16. (New)

1

The catalyst as claimed in claim ~~7~~¹, wherein the catalyst consists essentially of mixed oxides of copper, chromium, aluminum and zinc.

REMARKS

The Official Action of December 5, 2000 has been carefully considered and reconsideration of the application as amended is respectfully requested.

Claims 1 - 6 have been cancelled thereby removing the bases for the rejections to these claims appearing at paragraphs 3 - 7 of the Official Action. Claim 7 has been amended to remove the basis for the rejection at paragraph 8 of the Official Action, and claim 8 has been amended to remove the basis for the rejection at paragraph 9 of the Official Action. Support for the latter amendment appears in the specification as filed at page 4, first full paragraph.

New claims 14 -16 have been added more completely to define the subject matter which Applicants regard as their invention. Support for the recitations in claim 14 appears in the specification as filed at, for example, page 4, first full paragraph. Support for the recitations in claim 15 appears in the specification as filed at, for example, page 2, line 17; page 4, last

paragraph and the Examples. Support for the recitations in claim 16 appears in the specification at, for example, page 1, lines 10 - 11.

The claims stand rejected under 35 USC 103(a) as allegedly being unpatentable over Budge in view of Rashkin. Applicants respectfully traverse this rejection.

The claimed invention recites a very specific chromite catalyst having a definite molar composition comprising Cu, Cr, Al, Zn, and having a specific XRD pattern. As claimed, the catalyst must comprise all four (4) of these elements (and only these four elements) in the recited proportions. The Examples of the specification show the criticality of including in the claimed catalyst the four metals recited in the claims, and only those four metals, in the recited proportions. The Examples are summarized as follows:

<u>Example</u>	<u>Catalyst Components</u>	<u>Selectivity For THF</u>
1	Cu, Al, Zn, Cr	90%
2	Cu, Al, Cr	< 30%
3	Cu, Zn, Cr	< 25%
4	Cu, Cr	< 20%
5	Cu, Cr, Bn, Zn, Al	< 25%
6	Cu, Cr, Ba, Zn, Al	< 54%

Furthermore, as noted on page 10 of the specification, the catalysts of the claimed invention show prolonged activity (at least 630 hours).

It is respectfully submitted that the references cited by the Examiner do not show or suggest the recited molar composition or the recited XRD pattern of the claimed composition either alone or in proper combination. Even if Budge teaches a composition having a general formula which encompasses the recited molar composition (as alleged by the Examiner), this is

not sufficient to set forth a *prima facie* case of alleged obviousness absent a motivation or suggestion to select the specific species recited in the claims from the broad genus described in the reference (see MPEP Section 2144.08). Budge discloses a generic formula containing a large number of variables and encompassing a multitude of different possible compositions in addition to the recited molar composition. Indeed, the catalyst of Budge need not even include chromium (see Budge at column 4, lines 15 - 22). The elements which constitute M in the catalyst of Budge comprise practically the whole Periodic Table. Moreover, Budge clearly specifies that the concentration of M is between 0 and 200. There is nothing in Budge to show or suggest the selection of chromium in the recited mole percent, and indeed the Examples in Budge would not appear to show a mole percent within the recited range. In fact, the proportions of the metal components of the exemplified Budge catalysts vary significantly from that of the claimed invention and, where chromium is present, the mole percent is lower than what is claimed.

Where, as here, a generic formula in a reference encompasses a vast number of different compositions and the reference does not teach or fairly suggest the selection of a claimed composition from among the multitude of compositions encompassed by the generic formula, the reference cannot be said to set forth even a *prima facie* case for alleged obviousness (see *In re Baird*, 29 USPQ 2d 1550, 1552 (Fed. Cir. 1994)). Since the primary reference does not suggest selecting the claimed species from among the large number of species covered by the generic formula of the reference, and since the secondary reference does not supplement this deficiency in the primary reference, it is respectfully submitted that the references cannot be used to set forth even a *prima facie* case for alleged obviousness of the claimed invention for this reason alone.

In addition to the above, Applicants respectfully note that the cited references also do not show or suggest the recited XRD pattern for the claimed catalyst. The Examiner has acknowledged this on page 6 of the Official Action, but has stated that one of ordinary skill in the art would expect the XRD pattern to be the same since the claimed composition and the catalyst composition of the prior art allegedly comprise the same components and are allegedly made from the same starting materials by the same methods. However, as discussed above, the Budge formula encompasses an enormously wide range of compositions with different XRD patterns and there is nothing to show or suggest the selection from among these of the recited components in the recited amounts such that they would have the same XRD pattern. To the contrary, as next discussed, it is clear from a comparison of the properties of the claimed composition with the properties of the Budge composition that the respective compositions are different such that they would be expected to have different XRD patterns.

The teaching of Budge is very specific - a commercial copper chromite catalyst will provide enhanced selectivity for γ -butyrolactone only if a thick layer of catalyst particles are coated onto a larger inert support (column 2, lines 60 - 65; column 6, lines 54 - 68; column 7, line 24); the catalyst is non-homogenous (column 1, lines 65 - 68). The emphasis of Budge is that alteration of the catalyst particle size and the use of a support enhances the selectivity for γ -butyrolactone and prevents formation of or retention of succinic anhydride. As such, the focus is on enhancement of the selectivity for γ -butyrolactone (see also Budge at column 9, lines 32 - 35).

The catalyst of the present invention on the other hand has a very specific composition and XRD pattern which determines the properties thereof. As shown by the Examples, the

claimed composition results in a greater selectivity towards tetrahydrofuran.

In short, Budge does not show or suggest the selection of the claimed catalyst from among the myriad of catalyst compositions encompassed by the generic formula in Budge. Moreover, by teaching that the Budge catalyst should have a very specific selectivity, Budge actually teaches away from a catalyst having the recited XRD pattern. These and other differences between the Budge catalyst and the claimed catalyst are summarized below.

Budge uses a commercially available copper chromite catalyst which is coated on a commercially available support (Example I). The invention of Budge resides not in the formation of the catalyst but in the selection of a catalyst, the support, and the particle size of the catalyst to obtain a greater selectivity for γ -butyrolactone. (Practically the entire Budge specification emphasizes the importance of particle size to enhance selectivity to γ -butyrolactone). On the other hand, the claimed invention is a catalyst for conversion of maleic anhydride to tetrahydrofuran.

The catalyst of Budge need not include chromium (Budge at column 4, lines 15 - 22). The elements which constitute M in the catalyst of Budge comprise practically the whole Periodic Table. Additionally, Budge clearly specifies that the concentration of M is between 0 and 200. Thus, the importance of Budge or the teaching therein clearly is not the inclusion of the Cu, Cr, Zn and Al in specific proportions. In the claimed invention, the combination of the four stated elements is required.

Budge itself iterates that the invention resides in a supported catalyst (Budge at column

1, lines 58 - 68; column 2, lines 58 - 64). On the other hand, the catalyst of the invention may be used *without* a support. The catalyst of Budge is a supported non-homogenous catalyst (Budge at column 1, lines 66 - 68). The catalyst of the invention is an unsupported homogenous catalyst (see claim 16). It would then appear that Budge does not teach towards the invention but away from it.

In Budge, as in Rashkin, the catalyst does not need activation *in situ* and is used as such. In the invention, *in situ* activation is essential for the catalyst to be used.

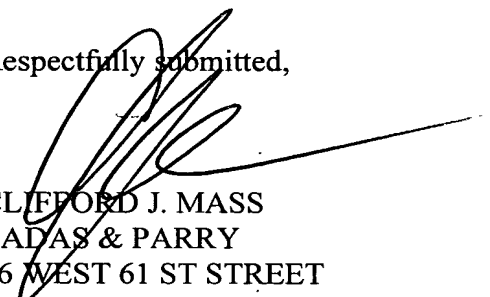
Budge teaches decreasing the particle size of the catalyst in order to enhance selectivity towards γ -butyrolactone. However, the claimed invention relates specifically to a catalyst with enhanced selectivity to tetrahydrofuran.

In Budge, the reactant succinic anhydride is left in the reaction mixture. In the claimed invention, the conversion of the starting material of diethyl maleate is complete. All the Tables in Budge specify that γ -butyrolactone is obtained in better yield than tetrahydrofuran. Indeed, Example 2 and Table II of Budge is devoted to a comparison of an unsupported catalyst with the supported catalyst of Budge in order to emphasize that the supported catalyst of Budge provides better results (see Budge at column 9, lines 32 - 35).

The secondary reference cannot supplement any of the deficiencies in Budge noted above. Accordingly, it is respectfully considered that the combination of Budge and Rashkin, even if proper, would not arrive at the claimed invention.

In view of the above, all rejections and objections of record are believed to have been successfully traversed and the application is believed to be in allowable form. An early Notice of Allowability is earnestly solicited and is believed to be fully warranted.

Respectfully submitted,



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